WHAT IS CLAIMED IS:

1. A method comprising:

selecting a configuration for layers of a permuting network based on a set of integer factors of N, the number of signals to be permuted, and on pre-selected types of switches; and

constructing the permuting network in layers by using the pre-selected types of switches based on the selected configuration.

2. The method of claim 1 in which each of the types of switches is capable of selecting one signal from among a number of signals, the number being different for different types of switches.

3. The method of claim 2 in which each of the integer factors corresponds to the number of signals that one type of switches can select from.

4. The method of claim 1, further comprising selecting the set of integer factors w_1, w_2, ..., w_D (D being an integer) such that $N = w_1 \times w_2 \times \ldots \times w_D$.

5. The method of claim 4 in which the permuting network is configured to have $2D$-1 layers of switches, the switches including w_1:1, w_2:1, .., and w_D:1 switches or are constructed from w_1:1, w_2:1, .., and w_D:1 switches.

6. A method comprising:

receiving N signals; and

re-ordering the N signals using a permuting network constructed from layers of switches having a configuration based on a set of integer factors of N and on pre-selected types of switches.

7. The method of claim 6 in which each layer has N switches of the same type, each type of switch having a predefined number of input terminals and one output terminal.

8. The method of claim 7 in which each layer of the permuting network groups the N signals into subsets of signals and permutes the ordering of the subsets of signals, the number of signals in the subsets being equal to the number of input terminals that each switch in the layer has.

9. The method of claim 7 in which the permuting network is constructed by assigning multi-dimensional coordinates to the switches, each switch in a layer having a different coordinate, and configuring the switches so that when a signal propagates from a first switch in one layer to a second switch in the next layer, the coordinates of the two switches differ in one dimension only.

10. The method of claim 6 in which the integer factors are $w_1, w_2, \ldots, w_D$ (D being an integer) such that $N = w_1 \times w_2 \times \ldots \times w_D$, and the pre-selected types of switches include w_1:1, w_2:1, ..., and w_D:1 switches.

11. Apparatus comprising:

N input terminals, N being an integer;

N output terminals; and

a permuting network configured to form non-blocking signal paths that connects the input terminals to the output terminals in an arbitrary order, the permuting network constructed from layers of switches of different types, each layer having the same number of switches of the same type, each type of switch capable of selecting one signal from among a predefined number of signals.

12. The apparatus of claim 11 wherein each switch has input and output terminals, the input terminals of the switches in the first layer coupled to the N input terminals of the apparatus, the output terminals of the switches in the last layer coupled to the N output terminals of the apparatus, and for all layers except the last layer, the output terminals of the switches are connected to the input terminals of the switches in the next layer.

13. The apparatus of claim 12 in which the number of layers and the connection between switches of successive layers are based on a set of integer factors of N and on the types of switches used.

14. The apparatus of claim 13 in which the integer factors are $w_1, w_2, \ldots, w_D$ (D being an integer) such that $N = w_1 \times w_2 \times \ldots \times w_D$, and the types of switches used include w_1:1, w_2:1, ..., and w_D:1 switches.

15. The apparatus of claim 14 in which the permuting network is configured to have $2D$-1 layers of switches, each layer permuting the order of different subsets of signal paths.

16. The apparatus of claim 15 wherein for each p-th layer of switches, p ranging from 1 to D, w_p:1 switches are configured to form w_p-by-w_p permuters that are capable of permuting

the ordering of w_p signal paths, and for each of the q-th layer of switches, q ranging from D+1 to 2D-1, w_{2D-q}:1 switches are configured to form w_{2D-q}-by-w_{2D-q} permuters that are capable of permuting the ordering of w_{2D-q} signal paths.

17. The apparatus of claim 16 in which each of the input terminals of each permuter in the 2nd layer to the $(2D\text{-}1)^{th}$ layer is connected to the output terminal of a different permuter in the previous layer.

18. Apparatus comprising:

a first device configured to generate N signals having a first ordering;

a second device configured to accept the N signals arranged in a second ordering; and

a permuting network configured to receive the N signals having the first ordering and re-order the N signals so that the N signals have the second ordering acceptable by the second device, the permuting network constructed from layers of switches of different types, each layer having the same number of switches of the same type, each type of switch capable of selecting one signal from among a predefined number of signals.

19. The apparatus of claim 18 in which the number of layers and the connection between switches of successive layers are based on a set of integer factors of N and on the types of switches used.

20. The apparatus of claim 19 in which the second device is a memory.

21. The apparatus of claim 20 in which the first device is a computer motherboard.

22. The apparatus of claim 19 in which the integer factors are w_1, w_2, ..., w_D (D being an integer) such that $N = w_1 \times w_2 \times \ldots \times w_D$, and the types of switches used include w_1:1, w_2:1, ..., and w_D:1 switches.

23. The apparatus of claim 22 in which the permuting network is configured to have $2D$-1 layers of switches, each layer having N switches of the same type, each layer permuting the order of different subsets of the N signals.

24. A computer program stored on a computer-readable media for causing a computer system to perform the functions of:

assigning a multi-dimensional coordinate to each of a set of N signals, N being an integer;

in successive operations, changing the coordinates of the N signals for a particular dimension during each operation, such that no two signals have the same coordinates after each operation, so that after the successive operations, the coordinates of the N signals match a set of target coordinates.

25. The computer program of claim 24, further causing the computer system to perform the function of finding integer factors w_1, w_2, ..., and w_D of N such that $N = w_1 \times w_2 \times \ldots \times w_D$, D being an integer.

26. The computer program of claim 25 in which the multi-dimensional coordinates are $[x_1, x_2, \ldots, x_D]$, x_k ranging from 1 to w_k for each k, k ranging from 1 to D.

27. The computer program of claim 26 in which the coordinates of the N signals are changed by swapping the coordinates of a pair of signals.

28. Apparatus for re-ordering N signals, comprising:

$(2D - 1)$ layers of switches, D being an integer, the n-th layer and $(2D - n)$-th layer having w_n-by-w_n switches, n ranging from 1 to D, and w_1 to w_D being integer factors of N such that $N = w_1 \times w_2 \times \ldots \times w_D$, the first layer of switches re-ordering the order of N signals to generate a first set of re-ordered signals, the i-th layer of switches re-ordering the $(i$-1)-th set of re-ordered signals to generate an i-th set of re-ordered signals, i ranging from 2 to $2D$-1, the $(2D$-1)-th set of re-ordered signals matching a target ordering of N signals.

29. The apparatus of claim 28 in which each of the N signals are assigned D-dimensional coordinates, the n-th coordinate ranging from 1 to w_n, the p-th layer switches configured to swap signals that differ only in the p-th coordinates with the coordinates in other dimensions being the same, p ranging from 1 to D, and the q-th layer switches configured to swap signals that differ only in the $(2D$-$q)$-th coordinates with the coordinates in other dimensions being the same, q ranging from D+1 to $2D$-1.